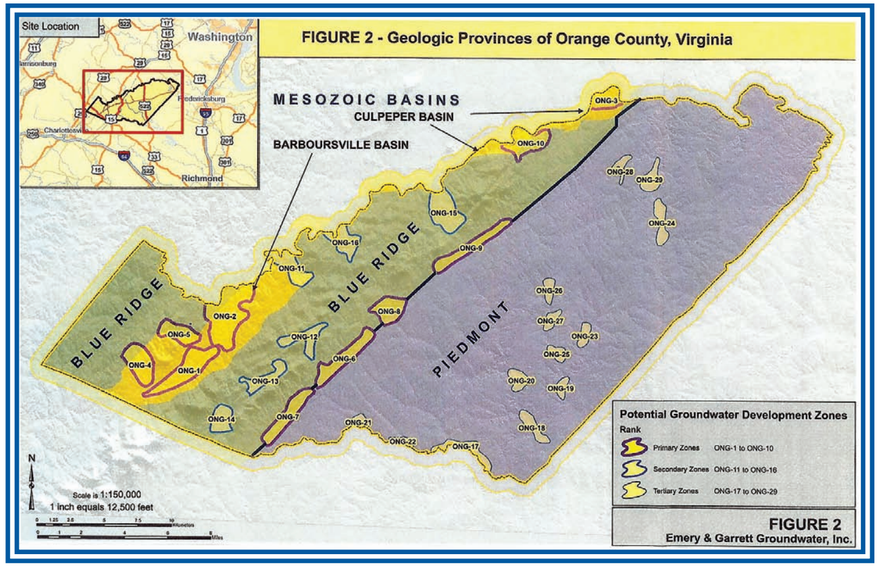
tion system. Such closed systems tend to attract minerals and bacteria, continues White, which means this well water will have to be treated before it is transported by new pipelines along easement and land conservation-intensive Rt. 231 to Gordonsville. One more thing: this is the same area where a uranium mining outfit was sniffing around in the early 1980s. There may be radon in this water.

Going back to our little lesson on ground water, it all depends on how many water bearing fractures are in the rock. And the only way to know for sure is to bore the production well and then bore observation wells all around it. Then, White says, "pump it hard for 48 hours to determine the aquifer characteristics, whether it can recover, how quickly it draws down, how fast it moves through the formation, how much storage is in there…These are all things that we don't know. And until you get a handle on those parameters, you're just guessing."

Of course the big question is, if you drill 10 wells, each producing 139 gallons of water per minute, 24-7, what is that going to do to the existing residential wells in the area? "Uh yeah," says White. "I think you would probably see a shift from the predominant groundwater gradient in the basin." In other words, yes, the static level would go down. But would it go down until your well runs dry? There's no way of knowing until you try it, and by then it might be too late.

Meanwhile, out in Somerset, in the middle of this Barboursville basin sits the remnants of the General Shale, formerly Webster Brick, factory. This land is already zoned industrial. The deep huge quarry-like holes in the ground that produced the shale that produced the signature red brick since the 1940s have filled up with water. They are brimming with it. Hmmmmm.

Water is the source of life, both biologic and economic. And economics hinge on the simple rule of supply and demand. If we grow, demand will increase. We've just got to find a reliable supply to keep up with that increased demand. Otherwise we will start to run out of water in four years.



The Wiley/Wilson study recommends drilling 10 wells in these 10 primary zones (ONG-1 through ONG-10) to produce 2 million gallons per day to tide us over until we can build impoundments to tributaries of the Rapidan River. Note the four sites that follow the narrow Everona limestone band diagonally through the county and the four sites in the Barboursville Basin.

The Wilderness Treatment plant provides the Lake of the Woods area with 525,000 to 1.1 million gallons of water per day, but it is licensed to withdraw as much as three million per day.

Water, water everywhere...

The Rapidan River provides for half of Orange County's water needs, anywhere from 1.4 to 2.7 million gallons of water per day.

and not a drop to...WASTE

Part II

"Some public water systems in Orange County could experience periods of water shortage as early as 2010."

That is a direct quote from page three of a 347-page study about Orange County's water. The study, prepared by an engineering firm, named Wiley/Wilson Constant Progress, was revised and updated just last year. There's more.

"Although the duration and frequency of these water shortages cannot be accurately predicted, they will most likely first occur during the late summer and early fall, when the stream and groundwater levels are typically at their lowest." We're talking about right NOW.

The study's executive summary prophetically concludes, "All residents could be impacted, even though roughly half of the residents depend on the Rapidan River as a supply and the other half depend on groundwater. Dry wells could force some residents to purchase and transport containers of water for basic domestic use, while residents on public water systems in the county could likely face mandatory restrictions that will limit water use."

Two weeks ago, in the first of this two-part series on our planet's most precious resource, we learned about rainfall and the Rapidan River. We learned that although we are not drier on a 12-month basis, we do experience regular dry spells during hot summer months when all living things need water the most. We also learned that during those hot summer days, we actually experience a net loss in moisture due to evapotranspiration. And we learned that sudden heavy downpours run off more than they soak.

We also learned that the Rapidan River is flowing even slower than its usual slow summer pace. We learned that we must listen to this shallow stream; that it is telling us it is naturally limited on how much water it can provide to our ever increasing population. We learned how half of Orange County receives its water from this river. That includes all the folks at Lake of the Woods, plus some additional homes and businesses across Rt. 3, and just about every residence, business and industry in and around Orange and Gordonsville and some along Rt. 15 between the two towns.

We also learned that our memories are short, that barely eight years ago the Town of Orange flat ran out of water. We learned, in the words of Chief Operator Dwight Baker of the Orange Water Treatment plant to "Never say 'never.'"

In this installment we will address where the other half of Orange County's population gets its water. And then we'll look at what the study suggests we do about the fact that if we're going to grow, which is inevitable, we need more water, and we need it now.

INSIDER

By Phil Audibert

September 2, 2010

Orange County Review INSIDER, September 2, 2010

Groundwater

The average household uses between 80 and 100 gallons of water per day. That is considered a low estimate, by the way. When planning for sewage treatment plants the number is 100 gallons per person per day.

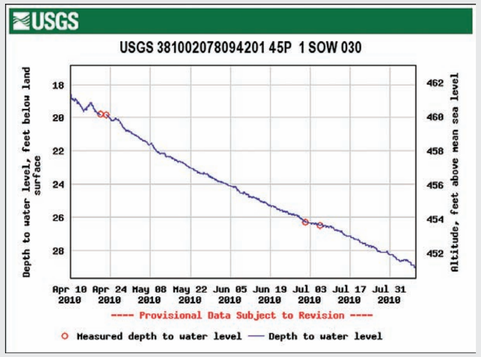
Anyway, the Wiley/Wilson study uses a 70-gallon per household estimate. There are 7,340 Orange County addresses that rely on wells for their water. They take 438 million gallons from out of the ground each year. That's based on 2.3 people per household. It works out to an average of 1.2 million gallons per day and a peak demand of 2 million gallons per day. Most of that, almost a million gallons, is coming out of private wells; the rest is for schools, community water systems and agriculture.

Anyway, at that rate, you might think the groundwater supply would be in danger of drying up. But it's not because it is constantly flowing and it is constantly being recharged by rainfall that managed to soak into the ground rather than run off to the Atlantic. Still, once in the ground, it is not yet free to recharge the ground water because it must first run a gauntlet past the millions of roots that want to send it up into trees and plants instead. So, of the 41.8 inches of rainfall we receive on average each year, the study says only 12.4 inches actually makes it into the surface and groundwater.

We talked to a groundwater geologist named Brad White and to a fifth generation well-digger named Dennis Gentry. And we asked them the big question: Is the water table going down? Both men say the short answer is 'no.' The long answer is a bit more complicated.

Basically Orange County sits atop two aquifers. One is called the Piedmont and the other the Blue Ridge. In the middle of the latter sits a Mesozoic basin, which stretches in a roughly three-mile-wide swath from Barboursville through Somerset, past the western edge of the Town of Orange before continuing and widening in Madison and Culpeper counties. Locally it is known as the Barboursville Basin.

Above, this observation well outside of Gordonsville has steadily recorded an average static water level of about 25 feet ever since 1965. But it fluctuates wildly on a seasonal basis. Below, the USGS constantly monitors the well. The 120-day trend shows the static ground water level has droppped 10 feet since April.



Orange County is not all in one river basin either. Water dumped or falling as rain in Orange County drains 55 percent to the Rappahannock and about 43 percent to the York, with a scant 2 percent going to the James. The boundary between these two major river basins runs basically along the ridgeline of the Southwest Mountains, that string of hills on the west side of Rt. 15 from Gordonsville to Orange. From Orange the line turns and pretty much follows Rt. 20 to Unionville and then turns southeast to include Mine Run and Wilderness.

The point needs to be made here that the Rapidan-Rappahannock watershed is being cheated. Not all the water that is pulled from it returns to it. Any water that is piped to Gordonsville exits to the York basin and shortchanges the Rapidan.

Back to groundwater. What we call the water table, is what Dennis Gentry calls "the first stream." In the old days, prior to 1965, when we would dig a well, by hand, or by augur, or by a chisel-like plunger, when we reached "the first stream," we would stop. Just outside the Town of Gordonsville, that first stream is about 25 feet below the surface of the ground. In some parts of the county it's more; in others it's less.

More importantly, that level varies up and down. Brad White of the Department of Environmental Quality says an observation well just outside the town of Gordonsville is constantly monitoring the static ground water level in real time. You can look at it yourself by going to the USGS web site. And if you look at the history of this well over the past 120 days you will see that the static water level has steadily declined from about 19 feet below the surface of the ground to almost 30 feet. That's a 10-foot drop in the groundwater level in four months.

But do not be alarmed…yet. Brad White says it will come back to its 25-foot average level once it rains. In fact this well, which has monitored ground water since 1965 has changed little since then. "There really has been no discernible long-term trend that I can see," says White. "It just sort of hovers around a mean value…I haven't seen any evidence that makes me say 'oh my gosh, we're running out of water;' not yet anyway."

But he quickly adds, "It exhibits a pretty wide range in fluctuation…This well shows a pretty dynamic shift seasonally. It's either we're getting too much water or not enough. It's hard for things to hover around a nice level." The level has been as high as 12 feet below land surface and as much as 39 feet below, which happened–you guessed it–in 2002.

Right about this time of year Dennis Gentry's phone starts ringing; panicked people whose wells have run or are running dry. He says in September, October and early November, the trees are trying to uptake as much water as they can before they go dormant. This can be the coup de grace to an already drought-stricken static water level.

So what do you do if your well runs dry, other than wait for the static water level to return to normal? "The only thing you can do is drill a new one," says Gentry. "A dry well will not hold water." In other words, if you truck in water and fill up your dry well the water will leak out to where the static water level has descended.

Gentry does not recommend that you simply dig an existing well deeper because "if you don't seal it off, you're going to have problems." He recommends drilling a new well. But first you must get a permit from the health department. Before he can do anything, a health department inspector must come out and outline general areas where a well may or may not be dug on your property. For instance, for obvious reasons, no well can be dug near a barn or feedlot, or within a certain distance of a septic system and drain field.

It's then up to the well-digger to select the right spot, and here-in lies a little bit of genius or, depending how you look at it, hocus pocus. Dennis Gentry is cagey about his methods, but he does say he uses a dousing technique, basically "a steel nut on a piece of hay twine." That simple device will indicate to him the location of flowing water in the "millions of crevices" that riddle bedrock well below that "first stream." Where those water bearing crevices intersect is the well-driller's sweetspot because they can bear copious amounts of water.

Gentry tells stories of drilling 600-foot dry holes, only to move over a few yards and hit 100 gallons per minute. He says confidently, "In 46 years, I can tell you within a foot where I'm going to hit the bedrock at and within a foot when I'm going to hit the water at."

A parched garden in Orange County.

Gentry says an average depth for a well in Orange County today is 165 feet, "no deeper than we were 40 years ago." With today's modern equipment he can drill a 220- foot well in two and a half hours, whereas in the old days it could take days. He usually starts out with a 10-inch bit to go through what's called the overburden. When he hits bed rock, he sets the casing and continues to drill with smaller bits until he gets to a depth that produces enough water. A typical well will cost about $3,500.

"There are big streams of water in certain portions of Orange County," says Gentry enigmatically, adding he has recently done yield and draw down tests on a "big producer" (he won't say where) that pulls 1.5 million gallons per month and "we have not at any point changed the static level over 18 inches."

So the long and short of it, depends on just that, the long and short of your well. If you have a modern deep well that has been sunk into bedrock, you're probably okay. If yours is one of the older style shallow ones, you may run out and you'll either have to dig a new one or wait until it recharges. And for that, we will need some rainfall.

And while you're ordering up some rainfall, make it happen in the late fall and winter when the trees are dormant and not hijacking the water on its way through the ground. Best of all, make it snow. While you were cursing those blizzards of last December and February, the groundwater system rejoiced. Both of those big snow dumps took their sweet time melting, which means much of that water trickled through the soil rather than run off on the surface. It was a groundwater bonanza…but it still isn't enough to push 2014 out a little further.

Solutions?

2014…that's the year the Wiley/Wilson study says we'll start running out of water…four short years from now. It won't happen to everyone, but it will to everyone who pays a water bill in Orange or in Gordonsville or along Rt. 15 between the two towns.

When Lake of the Woods starts to run out is a bit further off…2031, according to an update to that study that was presented to the board of supervisors recently. But that's where the growth is happening in this county. Consumption at the eastern end of the county increased from 127 million gallons in 2000 to 175 million gallons in 2005, an increase of 38 percent.

Overall, by the year 2050, the county will have a 4.61 million gallon per day deficit. That's the difference between supply and demand. "With increasing needs and limited supplies, the potential for future water shortages exists," drones the study, stating the obvious.

Some suggested solutions include piping water in from Louisa and Fluvanna counties, who are going through their own water crises themselves, particularly at Zion's Crossroads. And the study makes the usual plea for water conservation. It also points out that Gordonsville lost a potential water source when it sold 90 percent of its water rights to Bowler's Mill Lake to Louisa. Hindsight is always perfect 20-20.

More specifically, the Wiley/Wilson study recommends that the county immediately start the process for building impoundments to store raw water. Five sites have been earmarked: an unnamed tributary to Wilderness Run (near LOW), Mountain Run and Mine Run (both in the True Blue/Burr Hill area) and Poplar/Laurel Run (between Montford and Orange). For obvious reasons, raw water storage needs to be as close to a treatment facility as possible.

This is a lengthy and costly process. Each impoundment site will cost between $26 and $34 million to develop, plus an additional $15 to $21 million to run water lines. And the board of supervisors is understandably reluctant to use taxpayer money to fund projects that only half the population needs. Those of us on wells will never see any benefit from it. But the same argument can be made that those of us who don't have school-age children see no direct benefit in public education either. On the flip side, it is probably in everyone's best interest to have an educated populous that has enough water to drink, particularly in the county's economic centers.

The water storage permitting process is also time consuming, taking between 15 and 20 years to accomplish. One notable exception: Orange's 45 million-gallon raw water emergency reservoir which was funded and built in record time in response to the four-year drought emergency that occurred from 1998 to 2002. But we're not in an emergency right now; just headed for one. So what are we to do while we wait for that lengthy permitting, land acquisition, and construction process to unfold?

Bore wells, says Wiley/Wilson; 10 of them producing a combined 2 million gallons a day at a cost of $23 million. Groundwater geologist, Brad White does the math: 10 wells producing 2 million gallons per day means each well must produce 139 gallons per minute. He is skeptical that you can find 10 wells in Orange County that can do that.

The study lists 10 primary sites, presumably one well per site. Four of them run along a narrow band of rock called Everona Limestone, basically along Rt. 15 from Gordonsville to Orange and continuing in a straight line to Everona on the southeast side of Clark Mountain. Brad White says "I know for a fact that there have been some very productive wells drilled there." But he quickly adds, "Now, pumping 24 hours a day, I don't know."

Another two would go right up next to the Rapidan River near True Blue in the productive Culpeper basin. And another four would go in the aforementioned Barboursville basin.

Again, White turns skeptical. This is the one that runs in a three-mile-wide swath on either side of Rt. 20 from Barboursville through Somerset and Montford to just west of Orange. "It's sort of like a tub," he says of this geologic formation. "These strata are pretty tight. Compared to the Culpeper basin, it doesn't lend itself to fracturing as well, and the quality of the water is not as good as the Culpeper Basin."

This explains why my well was laced with iron and smelled of rotten eggs, until I put in an expensive water softening and purifica-